Santa Clara Valley Water District

San Jose, CA

AN EVALUATION OF MtBE OCCURRENCE AT FUEL LEAK SITES WITH OPERATING GASOLINE USTS

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EXECUTIVE SUMMARY

The Santa Clara Valley Water District (District) is committed to ensuring that groundwater basins in Santa Clara County (County) and drinking water resources are protected from contamination of Methyl tert Butyl Ether (MtBE). The District's Leaking Underground Storage Tank (LUST) Oversight Program ensures that known releases of fuel (and MtBE) from underground storage tanks (UST) are investigated and cleaned up such that drinking water resources are protected. However, the possibility for undetected releases to occur from operating UST facilities appears to be substantial and has been documented by the District's MtBE Occurrence and UST Study and other relevant studies summarized in this report. Given the possibility for undetected releases to occur and result in significant MtBE contamination in groundwater, additional assessment was performed. This report contains summaries of relevant UST and MtBE occurrence studies and includes the results of a detailed case study of 16 leaking underground storage tank (LUST) sites with operating USTs and high concentrations of MtBE in groundwater. The objectives of the detailed LUST case study is to evaluate potential causes of significant MtBE contamination at operating UST facilities, including an evaluation of whether undetected releases are occurring and identification of actual and potential weaknesses in fuel storage, management, and delivery operations.

The intent of this work is to provide information that can be used to identify and correct weaknesses in fuel UST management and recommend strategies to detect MtBE releases. Increased effectiveness in pollution prevention techniques and pollution prevention programs is the first line of defense in maintaining the high quality of the District's groundwater resource. This project is consistent with the District's core functions of delivering safe drinking water to the Santa Clara Valley and ensuring that the groundwater basins are protected.

BACKGROUND

MtBE is a synthetic organic ether that has been added to gasoline since the 1970s first as an octane enhancer after the phase out of lead (U.S. EPA, MtBE FAQ1), and more recently as a result of federal and state clean air requirements. Since 1995, responsible parties have been requested to analyze groundwater samples for MtBE in conjunction with investigation and monitoring activities associated with releases at LUST sites in Santa Clara County. This groundwater analytical data is submitted to the District's LUST Oversight Program. As this data was reviewed and entered in to the District's database, staff began to observe disturbing trends in the occurrence of MtBE at LUST sites with gasoline USTs still in use, particularly at retail gasoline facilities. These trends include high rate of detection, increasing concentration trends, and distribution of MtBE in groundwater.

LUST CASE STUDY

The objectives of each detailed LUST case study include: 1) determine whether detection of high concentrations of MtBE in groundwater at LUST sites is a result of undetected releases from new or upgraded UST systems, and 2) identify whether potential weaknesses in new UST systems and leak detection monitoring systems exist and if so, where these weaknesses are most likely to exist.

District staff reviewed available MtBE data for more than 150 LUST sites with operating USTs to select a final study population of 16 sites. The case study presented in this paper examines a population of 16 LUST sites with operating UST systems and high concentrations of MtBE in groundwater to evaluate the most reasonable source and cause of the MtBE contamination. The study sites were evaluated in detail to determine whether new releases were occurring and not being detected by the monitoring system. Both UST and LUST files were reviewed for release history information. The UST files were reviewed to obtain UST system construction, UST system monitoring, and facility compliance information. LUST case files were reviewed to identify contaminant trends and location of potential source areas. An evaluation of the available data was conducted in an attempt to identify potential source locations, possible release scenarios, and whether an undetected release was likely to have occurred.

SUMMARY OF FINDINGS

The results of the 16 case studies reveals that 13 sites are suspected of having had an undetected release from the current UST system and 2 sites are suspected of a pre-upgrade undetected release. The degree of certainty regarding the conclusions varies, but in general, an undetected recent release is the most reasonable explanation of the high and recently increased MtBE concentrations at the majority of these sites.

Two of the sites with significant MtBE plumes were only discovered to have had a release because of significant nuisance conditions that warranted investigation. In one case, vapors in an off-site sewer prompted investigation of the USTs. In another case, detection of MtBE in a nearby municipal well prompted investigation of the site. The release locations for these 2 sites have been confirmed. In one case, a leak in the primary piping drained to the Submersible Turbine Pump (STP) sump but was not contained or detected. In the other case, the owner has identified the release mechanism as a vapor release that was related to the vapor recovery system and potential breaches in various portions of the system.

A specific release mechanism could not be definitively identified for the other 14 sites. Two other sites that conducted detailed testing of secondary containment portions of the system found components that were not liquid tight (dispenser pans and turbine sumps), but a release from these components was not confirmed. An attempt was made to determine the most likely source location and release scenario resulting in significant MtBE concentrations at each of the 14 sites. An evaluation of the available data indicates the following suspected source areas:

- Twelve of the sites appeared to have source locations around the tank complex. Five of these are suspected of having releases associated with inadequate or absent sumps around the STP.
- Two sites appeared to have problems associated with the lined trenches.
- Two sites appeared to have source areas located around the tanks and piping
- Three sites appeared to have source areas near the piping/dispenser
- One site had inconclusive data

At least 7 of the 16 study sites had notices of violation or problems noted by the inspector related to monitoring system components. Four other sites had performed third party inspections which resulted in finding components that were either not liquid tight or not vapor tight.

All of the 14 case study sites that have had increasing trends of MtBE were cases where the original release was reported prior to 1990 and the tanks and piping were replaced prior to 1992.

CONCLUSIONS

The results of this study show that new or upgraded USTs do not afford 100 percent protection against fuel releases and UST monitoring systems are not necessarily effective in detecting releases, even for those sites which appear well maintained and operated. The results of the detailed LUST case study discussed in this report and the District's MtBE and UST Pilot Study indicate that for these recent and undetected releases, MtBE is the most significant fuel constituent detected in groundwater.

Review of overall groundwater data reported for operating gasoline facilities in Santa Clara County indicates a disturbing rate of occurrence and magnitude of MtBE in groundwater compared to sites no longer storing or dispensing fuel. The results of the detailed LUST case studies reveals that significantly increasing MtBE contaminant trends appear to be the result of undetected releases from new or upgraded UST systems. It is important to note that these high levels of MtBE contamination would not have been detected if environmental investigation or monitoring had not been conducted as part of a previous investigation and cleanup directives. The exception was for two cases where the MtBE contamination was only discovered due to nuisance conditions (vapor in sewer and water well impact) that prompted investigation of the sites.

For 13 of the 16 study sites, the specific causes of MtBE contamination cannot be definitively determined, but an undetected release was judged to be the most reasonable scenario based on the case study review. Inadequate or lacking secondary containment and improper monitoring seem to be a common theme associated with suspected undetected MtBE releases. Even with detailed system inspections and component testing, the release mechanism often remains elusive. However, detailed analysis of site specific data and UST inspection and compliance information does help to resolve some questions regarding potential sources and/or timing of releases.

Results of this and similar studies referenced in this report indicate the need for increased vigilance in maintaining, operating and inspecting UST facilities. Overall, the release mechanisms for MtBE at most LUST sites with MtBE in groundwater are not well understood. Due to the potential for undetected releases to continue to occur, and the occurrence of undetected releases that have not been identified, groundwater resources will continue to be threatened by the continued use of MtBE, or similar additives in gasoline.

RECOMMENDATIONS

The results of this and similar studies should be used to assess the threat to water resources posed by storage of fuels in USTs and the operation of fueling facilities. The level of threat posed is also directly related to the chemical properties of the fuel constituents**. Common areas of weaknesses in UST systems exist and have been identified by this and similar studies. Resources should be directed to those areas that present the most significant threat to water resources**

Whereas most of the cases examined in this study had double-walled tanks and piping, **particular attention should be paid to single-walled tank and piping systems which have no protection against low volume leaks** that may not be detected by monitoring systems or integrity testing.

Specific vigilance should be paid to these facilities. Conversely, **the mere presence of a double-walled UST system should not be considered guaranteed protection against undetected and/or significant releases.** It is imperative that secondary containment components are tested to determine if they are effective in containing and detecting leaks.

Fluctuating concentrations of MtBE in groundwater are observed at many operating LUST sites and can increase or decrease by orders of magnitude over a 1-year period. The reasons for such fluctuations are not clearly understood, and are seldom properly investigated or reported. The fluctuations observed at the study sites appear to be related to undetected releases at sites where UST are still present. **State and regional LUST program managers should carefully weigh the uncertainty associated with such reported groundwater monitoring data and consider the possibility of continuing releases prior to closing cases or in considering whether to re-open closed cases.** These considerations may include a review of facility management practices, appropriateness of existing groundwater monitoring well networks, release history, and underlying aquifer sensitivity the site.

The severity of MtBE contamination examined in this LUST population cannot be presumed to exist at all UST facilities. However, the District's Pilot Study of MtBE Occurrence Associated with Operating UST Systems found that minor to significant levels of MtBE contamination in groundwater can result from undetected releases at non-LUST sites and that MtBE could be present at up to 50 percent of the operating UST sites. This study found that high concentrations of MtBE contamination in groundwater appear to be the result of undetected releases at many sites. To verify if undetected releases have occurred at non-LUST sites and to determine the level of MtBE contamination, environmental monitoring (in this instance sampling of groundwater) is necessary. This should involve the collection of both soil and groundwater samples.

There is not currently a requirement for operating UST facilities to conduct environmental monitoring at non-LUST sites. Environmental monitoring should be considered the only method to confirm the presence of MtBE in groundwater and evaluate the threat that past and continuing undetected releases pose to groundwater resources. **The investigation of MtBE occurrence at all operating UST sites and gasoline stations should be a priority for any groundwater protection program in areas where MtBE or similar chemicals have been or are added to gasoline. In vulnerable groundwater areas the identification of these "undetected" MtBE groundwater plumes should be the foremost groundwater protection priority.**